# Effect of pH and protein concentration on the emulsifying properties of hyacinth bean (*Lablab purpureus*) protein nanoparticles.

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## Abstract

### Introduction

Nanoparticles can be used as emulsifiers for the stabilization of Pickering emulsions. The development of food-grade Pickering stabilizers is fast attracting interest as these are recognized as safe compared to inorganic materials. The amphiphilic nature of legume proteins provides them with excellent emulsion properties. Hyacinth bean is an indigenous leguminous crop to Africa predominantly found in eastern-southern Africa. Protein isolate produced from the seeds are sources of hydrophobic amino acids with solubility varying over wide pH. This makes it suitable for application as stabilizers of emulsion systems. Therefore, protein nanoparticles were produced from hyacinth bean protein isolate. This was to understand the effects of pH and protein concentration on their emulsifying properties for potential development as food-grade Pickering stabilizers.

### Methodology

Hyacinth bean protein nanoparticles were produced at a protein isolate concentration of 2% (m/v) by $Ca^{2+}$-induced aggregation (0-6.50 mM). The absorbance of dispersions was measured at 600 nm. Protein nanoparticles (pH 5-12) were characterized by dynamic light scattering, solubility, zeta-potential, and particle stability. Oil-in-water emulsions (10%) formed at protein nanoparticle concentrations (0.80-2.00% m/v) were subjected to accelerated storage (1 week/ 55 °C) and characterized based on morphology, emulsion stability, and droplet size distribution.

### Results and Discussion

The significant increase in absorbance values for dispersions indicated that protein aggregation was dependent on $Ca^{2+}$ concentration. Thus, the z-average diameter of protein nanoparticles increased at higher $Ca^{2+}$ concentrations. The solubility of nanoparticles varied extensively at different pH. The surface charge for protein nanoparticles became increasingly negative at higher pH. Nanoparticles (pH 5, 12) were relatively stable against 8 M Urea and 120 mM DTT at high protein concentrations. Emulsions produced were stable during storage with minimal changes to droplet size observed. Creaming indices were found dependent on protein nanoparticle concentration.

### Conclusion

Hyacinth bean protein nanoparticles were successfully produced using a non-thermal process. Nanoparticles (pH 7) were stable at high protein concentrations and demonstrated excellent surface properties. This was evident in the formation and stabilization of emulsions during storage with limited coalescence. Findings would be significant for the development of hyacinth bean protein nanoparticles as potential food-grade Pickering stabilizers.

## Categories

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